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THE MANUFACTURE OF INTERIOR DECORATION WALL PLATES FOR THE YIER--ETC(U)
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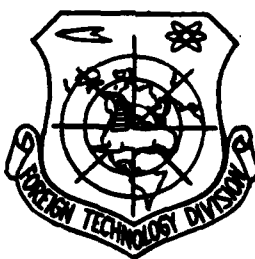
FOREIGN TECHNOLOGY DIVISION



THE MANUFACTURE OF INTERIOR DECORATION
WALL PLATES FOR THE YIER-86 AIRCRAFT

by

Qu Luzhou



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Soviet Aircraft Manufacturing Technology

THE MANUFACTURE OF INTERIOR DECORATION WALL PLATES FOR the YIER-86 AIRCRAFT

Interior decoration wall plates of wide bodied aircraft are only manufactured with honeycomb sandwich structures. Honeycomb sandwich structures are divided into the two classes of multi-layered and double layered. Generally, the multilayered structure uses ПСП-1 type or Nomex type polyamide honeycomb as the core material and the double layered structure is made of aluminum decoration plates. An aluminum decoration plate is an aluminum plate with a 0.1-20.3 millimeter thick polyvinyl chloride film glued to its surface. Neither semi-finished or finished aluminum decoration plates require heat treating. The metallic base plate of an aluminum decoration plate is a 0.8 millimeter thick

Д16-АМ (rate of elongation $\delta \geq 18\%$), АМ r 2-М... ($\delta \geq 25\%$) and АМn-М aluminum alloy plate material.

The decoration film of an aluminum decoration plate is a ПДС-20 and ПДС-12 polyvinyl chloride film. The polyvinyl chloride film has a transparent protective film layer and also possesses a clear multicolored pattern.

The interior decoration plate of the Yier-62 aircraft has 98 aluminum decoration plate parts and among these 30 are

hyperboloidic. The interior decoration plate of the Yier-86 aircraft has 785 aluminum decoration plate parts with a total weight of 1,450 kilograms. These include window wall plates, window frames, luggage racks and other parts.

Because there are very high requirements for the decoration plate parts (scratch marks, rubbing marks, creases or machinery marks are not allowable), a rubber hydraulic press with a specific pressure of more than 80 kilogram force/centimeter², a ЭГШ or ИЭГ press, electric hydraulic pulse forming equipment (fig.1) and a bending press are used for the forming of these types of parts.

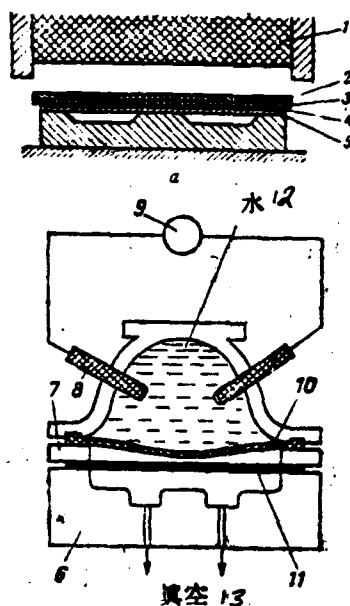


Fig. 1 Rubber Hydraulic Forming (a) and Electric Hydraulic Forming (a) of Aluminum Decoration Plate Parts

1. Rubber cushion of hydraulic press
2. Vacuum rubber plate
3. Polyethylene film
4. Polyvinyl chloride decoration film
5. Metallic base plate of blank aluminum decoration plate
6. Negative film

7. Side pressure ring
8. Electrode
9. Power source
10. Rubber or polyurethane diaphragm
11. Blank
12. Water
13. Vacuum

When the aluminum decoration plate part is formed on the rubber press and electric hydraulic pulse forming equipment, it is necessary to use polyethylene process film 3 which can be applied repeatedly so as to protect the decorating film of the aluminum decoration plate. Vacuum rubber cushion 2 with a thickness of 3-5 millimeters can also be used for protection, yet at the same time it is necessary that the vacuum decoration film face the rubber cushion. The forming process can be completed in one step but can also be carried out in several steps (fig. 2). Yet, it is not permissible to carry out further revisions of the parts after forming. Forming pressure lies in the 80-300 kilogram force/centimeter² range.



Fig. 2 Internal Decoration Wall Plate Parts Which Are Formed From Aluminum Decoration plates

a, window wall plate (first step is forming on
 наг -100H press, second step is forming on

hydraulic press); 6 circular porthole side frame; B, pressure plate in window (parts 6 and B are formed using a hydraulic press).

So-called electric hydraulic pulse forming is having a high pressure discharge in a water filled sealed container and passing shock waves through an elastic diaphragm at the time of discharge (fig. 1) so that the workpiece becomes deformed. Use of this method can guarantee that the interior decoration plate parts are drawn and thus there can be no damage to the surface of the parts. When there is a pressure bending part on the bending press it is necessary to use a special polyethylene film to protect the decoration film of the aluminum decoration plate (fig. 3). After forming and pressure bending, the hand is used to strip off the polyethylene film. It is not necessary to use any special equipment or tools for the stripping process of the part.

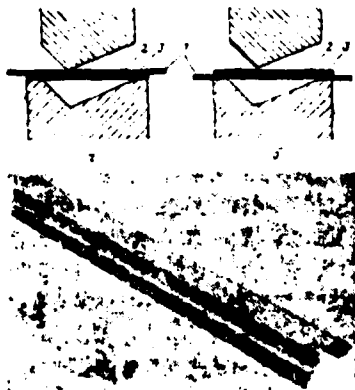


Fig. 3 Schematic of Aluminum Decoration Plate Part Pressure Bending

- a, the decoration film of the aluminum decoration plate is on the concave bend surface;
 - 6., the decoration film of the aluminum decoration plate is on the convex bend surface;
 - B, typical part (luggage rack) on the «УЗНННННННН» bending press using aluminum decoration plate.
1. Polyethylene protective film;
 2. Aluminum decoration plate blank;
 3. Decoration film of aluminum decoration plate.

When forming the part, the bottom and wall transition radius is 1-9 times as large as the recommended value for most aluminum alloy plate parts (in view of the forming method, that is, whether the convex edge shifts and is then fixed). The relative depth of the forming is 20-25% smaller than the recommended value of a common aluminum alloy part.

When squaring shears are used for cutting, the decoration film of the aluminum decoration plate should face the surface of the moving blade. To protect the decoration film surface from getting dirty a layer of thick paper must be used on the film surface. When forming the sheared aluminum decoration plate blank, the decoration film of each plate should face the surface of the moving blade.

When the milling sample plate mills the aluminum decoration plate on the milling machine, a sandwich layer of thick paper should be inserted within the blank so as to prevent the cutting from entering into the crevice of the blank. Generally, the feed should be 20% less than the recommended value.

When punching, it is necessary to add another layer of thick paper on the aluminum decoration plate for protection. At this

time, the decoration film should face the surface of the punch.

The hand is used to hold a pneumatic drill or fixed drilling machine when boring holes in the aluminum decoration plate. When boring the holes, the decoration film should face the surface of the bit. After drilling, a common burr scraper is used to clear away the burr on the sides of the hole.

The smallest bend radius of the aluminum decoration plate part is the same as the bend radius of a common metal part. The technical equipment used for forming aluminum decoration plates is the same as general forming technical equipment. The materials used for manufacturing forming film and punching film are rubber pressure layer plates, regenerative aluminum (fig. 3), zinc alloy and steel (to manufacture the bend pressure head).

It is best to use a rubber pressure layer plate with minimum friction factor as the material for forming film. The smooth finish of the metallic mold processing is not lower than 1.25 microns.

Among the equipment used for forming aluminum decoration plate parts there are: the QRD-600, QAB-31.5, П-307 hydraulic presses, the ПЭГ electric hydraulic pulse forming machine, УЭГП -150 forming equipment possessing four discharge chambers with storage energy of 150 kilojoule (the sustaining capacity of the bench is 7 tons and the maximum size of the plate is 3,200-1,800 millimeters), and the "Универсаль" bending press. A squaring shears, hand shears and milling machine are used when putting in the aluminum decoration plates.

81% of the parts of the interior decoration wall plate are formed by a rubber hydraulic press, 2.4% by ПЭГ-100H electric hydraulic pulse forming equipment, and 16.6% by a bending press. The entire work is completed in a special industrial chemical section. The bench used for aluminium decoration plate part processing and the bench used for depositing parts both have thick cotton flannel for protection. The finished product must be packed singly or in a batch by polyethylene.

Use of aluminum decoration plates can cause the mechanization level of manufacturing interior decoration plates to increase to 80% and cause the amount of labor for this work to decrease. To raise the incombustibility of the interior decoration plate components and lower the noise in the passenger cabin, interior decoration plates in passenger cabins of wide body aircraft often use multilayered wall plates with ПЧН-1 or Nomex honeycomb cores. Moreover, the majority of these types of wall plates are surface plates with a porous silencing honeycomb structure.

The typical structure of an interior decoration plate in a wide body aircraft is shown in fig. 4.

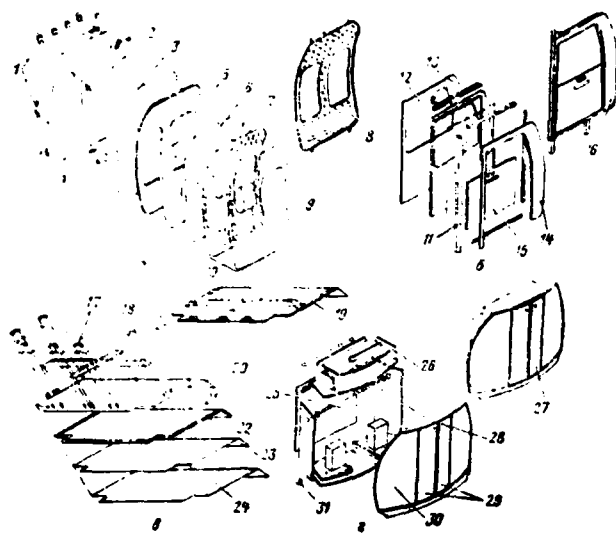


Fig. 4 Structure of an Interior Decoration Plate in a Boeing 747 Aircraft

a. side wall plate; 6. diaphragm; B. ceiling plate;
 r. cabinet; 1, 17 and 31. joints; 2. peripheral fixed
 mold material; 3, 6 and 20. preimpregnated plates;
 4 and 21. honeycomb cores; 5 and 23. glue films;
 7 and 24. decoration films; 8. finished wall plate;
 9. transparent thin film; 10. decoration layer; 11 and
 25. aluminum alloy extrusion mold material; 12 and 22.
 foam filled edges; 13, 14 and 30. decoration layer
 plates; 15. moveable decoration layer plate; 16.
 finished diaphragm; 18. glued frame of wall plate;
 19. finished ceiling plate; 26. glued wall plate;
 27. finished cabinet; 28. door lock; 29. door.

The surfaces of the interior decoration plates of American Boeing 747 aircraft (the same as other wide body aircraft) have porous silencing plates of decoration film (B of fig. 4) and holeless surface plates of common honeycomb wall plates (a, 6 and r of fig. 4). Further, they also use painted wall plates with patterns for door frames, luggage racks and other interior decoration plate components. There is hardly any difference in the manufacturing techniques for these types of wall plates. Most of them include the following processes.

1. The manufacture of decoration layer 10 (fig. 4) on a press causes the decoration layer and preimpregnated plate to be pressed together and to be punched on the pressed multilayered plate.

2. The cutting of preimpregnated plates 3 and 6 (glass fiber plate of impregnation with more than one half a liquid epoxy resin), and the preparation and manufacture of honeycomb core 4.

3. Wall plate part assembled together by glue film 5 and periphery of wall plate filled with polyurethane foam or another foam plastic.

4. A vacuum nylon bag is used to create a vacuum for the assembled wall plate.

5. The wall plate in the nylon bag and vacuum is placed in an air furnace at 120°C for heating solidification. After heating solidification it is cooled down to room temperature, the wall plate is taken out of the clamping apparatus and a protective film is applied on the decoration film.

(Translated and edited by Qu Luchou)